

Remarks

Claims 1-33 have been cancelled. New claims 34-51 have been added to the application. The specification including abstract of the English language translation of the subject application have been amended to conform to United States Patent and Trademark Office practice and to correct typographical and grammatical errors occurring as a result of the translation. A substitute specification with markings showing changes has been submitted herewith. The substitute specification contains no new matter. A clean version of the substitute specification has also been submitted herewith.

Examination of the application as amended herein is respectfully requested.

Respectfully submitted,

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SEALED PLUG CONNECTION THROUGH A PARTITION WALL AND
METHOD OF FITTING

5 FIELD OF THE INVENTION

The present invention relates to a plug connection for producing at least one electrical connection through an opening in a partition wall. The plug connection, which is also known as a through plug, comprises a first and a second plug, which can be plugged together, and at least one of the plugs can be sealed from the partition wall by means of a seal that surrounds the 10 opening. The invention relates, in particular, to a plug connection, wherein at least one of the plugs of said connection ~~comprising~~ comprises a clamping device which can be engaged with the other plug and enables the two plugs to be ~~clamped~~ drawn permanently in the direction in which they are plugged together; with interposition of the partition wall therebetween. The invention also relates to a method of fitting for producing an electrical plug connection of this type.

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BACKGROUND OF THE INVENTION

With a known generic plug of the type shown, for example, in the published international patent application WO 2004/047234 A1, the two plugs are clamped to one another with interposition of the a partition wall therebetween by means of a sliding slideable clamping device 20 which is displaceable for clamping the two plugs in a direction substantially transverse to the a direction of a passage through the partition wall. Guide rails convert the pushing force into a clamping force.

However, this known clamping device is accompanied by the problem that moisture can penetrate at the joints between the clamping device and the plugs, which can and lead to failure 25 of the plug connection.

BRIEF SUMMARY OF THE INVENTION

It is accordingly the an object of the invention to improve provide a generic plug connection and a method of fitting of the aforementioned type in such a way that the the same, wherein the plug connection has an improved seal from the environment and the security of the connection can be is increased.

According to the present invention, this object is achieved by a plug connection having the features of claim 1. The object is also achieved by a corresponding method of fitting comprising the steps of the independent method claim.

A further object of the invention is to improve provide a generic plug connection and a method of fitting of the aforementioned type in such a way that the same, wherein at least one of the two plugs of the plug connection can be fixed as easily as possible on the a partition wall and fitting errors can easily be detected.

This object is achieved by a plug connection having the features of claim 27 and by a corresponding method of fitting having the steps of claim 33.

15 A plurality of subclaims relate to advantageous developments of the present invention.

The present invention is based on the fundamental idea that the undesirable penetration of moisture into the an interior of the a plug connection can be avoided if the a connection region between the a clamping device and the at least one plug of the plug connection is sealed by a sealing devicemember. According to an advantageous embodiment, the clamping device comprises at least one actuating projection which co-operates with a socket arranged on one of the plugs, to clamp the plug. The force applied during clamping can easily be converted into a clamping force in this way.

In order to ~~minimise~~ minimize the region which a sealing device-member of this type has to seal, the clamping device in an advantageous embodiment can comprise a locking lever which, for clamping the two plugs, is pivotal about an axis of rotation extending substantially transversely to the passage-a direction of a passage through the partition wall. With an arrangement of this type, it is merely necessary to seal the region in which the locking lever is rotatably mounted.

In order to achieve particularly effective conversion of power from a pivoting movement into a clamping force for clamping the two plugs, at least one tooth with involute tooth faces can be arranged on each of the bearing projections projection as the an actuating projection.

According to an advantageous embodiment, the clamping device comprises a locking lever with a base region and two leg regions. ~~The Bearing-bearing projections~~, which are rotatably connected in corresponding bearing recesses in one plug, are formed on the-leg regions. In this way, the locking lever can be made, in a particularly simple manner, to be pivotal about ~~an~~ the axis of rotation extending substantially transversely to the passage-the direction of the passage through the partition wall, in order to clamp the plugs. The sealing device-member can then be arranged on the bearing projections, for example, in the form of an O-ring; or, alternatively, is sprayed directly onto the bearing projections.

A particularly inexpensive, simple embodiment of the sealing device-member according to the invention is achieved if the sealing device-member is formed by a resilient O-ring.

The seal from the partition wall has to be arranged peripherally around the-an opening in the partition wall. According to an advantageous embodiment, the seal can be sprayed onto the ~~an~~ outer periphery of the plug, so the seal is arranged captively on the plug housing. In addition, the connection between the seal and the plug, on which it is sprayed, is always completely tight.

However, this seal can also be a separate part-member which can be brought into contact with both the plug and the partition wall.

To prevent unintentional release of the clamping device, a separate securing device, which is also described as the-a connector position assurance (CPA) member, can be provided to 5 arrest-secure the clamping device in a finally fitted state.

The securing device is releasable in a particularly compact manner if it is displaceable in a direction transverse to the passage-direction of the passage through the partition wall.

A catch lug, which is provided for latching the clamping device on the securing device, represents a particularly effective, easily produced locking meansmember.

10 A correspondingly sealed sliding clamping device can also be used as an alternative to the pivotal locking lever, and this is beneficial, for example, if the available space does not allow pivoting of the locking lever during fitting. The clamping device can be a sliding device comprising at least one step-up or step-down arrangement. This allows an applied sliding force or movement to be transformed into a greater or smaller clamping force or movement.

15 It is particularly advantageous if the clamping device is a sliding device which is displaceable in a direction substantially transverse to the passage-a direction of a passage through the partition wall, in order to clamp the plug. This results in a particularly simple clamping device on the plug connection, and the clamping can be carried out very quickly and easily and the necessary space can be minimisedminimized.

20 In a further advantageous embodiment of the invention, the clamping device can comprise at least one guide rail which extends in part in a plane longitudinally to the plugging-together direction and substantially transversely to the plugging-together direction. This enables a sliding force or movement to be transformed into a clamping force or movement.

If a sealing ~~deviee-member~~ is provided on an opening of a first plug housing, through which an engagement element of the clamping device dips, then a clamping device configured as a sliding device can be particularly effectively sealed from penetrating moisture. A seal of this type can be sprayed on, for example, and can also have complicated cross sections, for example

5 with at least one sealing lip, to improve the tightness.

A particularly reliable seal, which can be produced with minimal force, can be achieved if at least one sealing projection, which cooperates with the sealing ~~deviee-member~~, to seal the plug connection, is formed on a second plug housing.

Since a locking device is additionally provided, which is movable between a locked position, in which the second plug is fixed on the partition wall, and an unlocked position, particularly secure fixing of the second plug on the partition wall can be achieved. A locking device of this type, which can also be described as ~~further-a~~ connector position assurance (CPA) member, can be constructed in such a way that unlocking is also possible and the second plug can easily be removed from the partition wall in the event of a repair. On the other hand, if relatively

10 great forces have to be applied when plugging in the first plug, it is possible to ensure that the second plug is not unintentionally released from the partition wall. In particular, if this second plug is held in a vehicle body panel, of which the back is not readily accessible at the moment of plugging together, as is the case, for example, with a car door, the solution according to the invention avoids the situation where the second plug can no longer be correctly contacted. Since

15 the locking device is mechanically fixed in the unlocked position, a defined position of the locking device can be ensured in the pre-fitted state.

At least one catching device can also be arranged on the locking device in order to secure the locking device in cooperation with an associated latching opening in the locked position.

This is particularly important in applications in the automotive industry, in which pronounced mechanical and thermal stresses occur during operation.

To prevent the locking device from unintentionally moving from the unlocked position, at least one catching device can cooperate, in the unlocked position, with a further associated catching catch opening, in order also to fix the locking device in this position. This catching connection is expediently accessible from the exterior (at least to a suitable tool), so that it is releasable, should removal be desired.

In the simplest case, the locking device can be displaceable relative to the second plug in the direction in which the two-plugs are plugged together. However, this solution has the drawback that it cannot be ensured that the two-plugs are plugged-in only when the locking device is correctly located in its locked position. In order to ensure, in a particularly simple manner, that the two plugs can be plugged-in only if the second plug is located in its final position in the opening in the partition wall and the locking device is correctly locked, the locking device can be mounted on the second plug housing by means of a hinge-like connection and be movable between the locked and the unlocked position by a pivoting movement about an axis of rotation extending substantially transversely to the passage-a direction of a passage through the partition wall.

In an embodiment of this type, for example, an edge region remote from the axis of rotation can then be arranged in the second plug housing in such a way that the two-plugs ~~cannot~~ ~~can not~~ be plugged together in the unlocked state.

The locking device proposed in conjunction with the present clamping device can obviously also be used for other plug connections.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail hereinafter with reference to the embodiments illustrated in the accompanying drawings. Like or corresponding parts of the plug connection according to the invention are provided with like reference numerals in the figures, in which:

5 Fig. 1 is a perspective, partially open view of a plug ~~connection~~ according to a first embodiment showing first and second plugs fitted in an opening in a partition wall;

Fig. 2 is a perspective view of the plug connection according to the ~~invention~~ first embodiment rotated relative to the view in Fig. 1;

10 Fig. 3 is a perspective view of the plug connection according to the first embodiment, in which ~~one of the two plugs~~ second plug is held in the opening in the partition wall and the ~~other~~ first plug is positioned in readiness a state ready for fitting prior to plugging together;

Fig. 4 is a perspective, partially exploded view of the first plug according to the first embodiment;

15 Fig. 5 is a perspective, partially exploded view of the second plug according to the first embodiment;

Fig. 6 is a perspective view of the second plug held in the partition wall according to the first embodiment;

Fig. 7 is a perspective, partially exploded view of a first plug according to a second embodiment;

20 Fig. 8 is a perspective, partially exploded view of a second plug according to ~~a~~ the second embodiment;

Fig. 9 is a perspective view of the first plug from Fig. 7 according to the second embodiment in readiness a state ready for fitting;

Fig. 10 is a perspective view of the second plug according to the second embodiment held in the partition wall;

Fig. 11 is a perspective, partially open view of the a plug connector connection according to the second embodiment fitted in the an opening in a partition wall;

5 Fig. 12 is a partially sectional view of the second plug according to a further advantageous the second embodiment during fitting shown being fitted in the partition wall;

Fig. 13 is a partially sectional view of the second plug according to Fig. 12 the second embodiment after fitting in the partition wall;

10 Fig. 14 is a perspective view of the second plug from Fig. 12 according to the second embodiment;

Fig. 15 is a perspective, detailed view of the second plug according to Fig. 12, the second embodiment showing a locking device being shown in the a pre-fitted state;

Fig. 16 is a perspective, partially open detailed view of the second plug according to Fig. 12, the second embodiment showing the locking device being in the locked state;

15 Fig. 17 is a perspective view of a plug connector connection fitted in the an opening in a partition wall according to a further advantageous third embodiment;

Fig. 18 is a perspective view of the a second plug from Fig. 17 according to the third embodiment;

20 Fig. 19 is a perspective view of the plug connector connection from Fig. 17 according to the third embodiment before the a first plug and the second plug are plugged together;

Fig. 20 is a perspective, partially exploded view of the first plug from Fig. 17 according to the third embodiment;

Fig. 21 is a perspective view of the first plug from Fig. 19 according to the third embodiment in readiness a state ready for fitting;

Fig. 22 is a perspective view of a single-part embodiment of the seals from Fig. 21 on the first plug according to the third embodiment;

5 Fig. 23 is a perspective view of the second plug according to Fig. 19, the third embodiment held in the partition wall; with seals;

Fig. 24 is a perspective, partially open view of the second plug according to Fig. 19 the third embodiment with an unlocked locking device;

Fig. 25 shows a detail is a detailed view of Section D from Fig. 24;

10 Fig. 26 is a perspective, partially exploded view of the second plug from Fig. 19 according to the third embodiment.

DETAILED DESCRIPTION OF THE INVENTION

In a first embodiment Figs. 1-6 show a plug connection 100 according to a first embodiment of the invention. As shown in Fig. 1, the plug connection 100 according to the invention comprises a first plug 1 and a second plug 17. The second plug 17 is fitted in a partition wall 37. According to the present embodiment, the second plug 17 is a pin-type plug and the first plug 1 is the associated a corresponding socket-type plug, though however, this arrangement is not essential to the present invention as the arrangement of pins and sockets could also be reversed.

According to the invention, the first plug 1 is sealed from the partition wall 37 by means of a peripheral seal 28. As will be described hereinafter with reference to Figs. 3 and 4, the plug connector connection 100 according to the invention comprises a clamping device 160 which, in

the a finally final fitted position shown in Fig. 1, elamps draws the two first and second plugs 1, 17 together with interposition of the partition wall 37 therebetween. According to a first embodiment of the invention, a locking lever 160 acts as the clamping device is formed as a locking lever 160. The first plug 1 comprises a first plug housing 2, a connecting piece 7, to which a bush (not shown) can be attached, a first pin recess 5, and a second pin recess 6. The bush, which is (not shown) here, and the connecting piece 7 form part of a channel through which a cable (not shown) can be introduced into the an interior of the first plug housing 2.

To prevent the penetration of moisture into the interior of the first plug 1 at the connection point between the first plug housing 2 and the locking lever 160, the first plug 1, according to the invention, has a sealing device member 162. In the embodiment illustrated, this the sealing device member 162 is embodied by a simple O-ring. However, other methods of producing the sealing device member 162 can obviously also be employed such as, for example, spray-on seals or seals of complex shape comprising, for example, sealing lips.

As will be illustrated shown in Fig. 3], the sealing member 162 is arranged on a bearing projection 164 which holds the locking lever 160 pivotally in the a direction of arrow 166 in a bearing recess 168 of the first plug housing 2. Owing to the specific configuration of the sealing device member 162 as an O-ring, the seal provided by the sealing member 162 can be ensured in a particularly simple manner despite the movability of the locking lever 160.

To illustrate the construction of the locking lever 160, the plug connection 100 according to the invention is shown again in a rotated perspective view in Fig. 2. This view shows that the locking lever 160 is protected from unintentional unlocking in the direction of the arrow 166 by a securing device 170. The securing device 170 comprises a catching device lug 172 for latching with the a catch opening 174 of the locking lever 160. With this arrangement, the locking lever

160 can be prevented from pivoting unintentionally so that the sealing clamp between the two
first and second plugs 1_a and 17 is not unintentionally released, on the one hand, whereas and the
catching device 172 is easily accessible from the an exterior of the first plug housing 2 so that it
the catching device 172 can be opened if necessary (at least with a suitable tool), on the other
5 hand.

Fig. 3 shows the first embodiment of the plug connection 100 according to the invention
in the an unfitted state. The second plug 17 is already fitted in the partition wall 37. A resilient
spring-catch arm 152 with a catch lug 131, which are formed on the a second plug housing 25,
and secure the second plug 17 in the an opening 39 in the partition wall 37. Space can
10 additionally be saved during fitting as the second plug 17 does not yet have to rest securely on the
partition wall 37 in this "parking position" unfitted state but, if necessary, is still displaceably
mounted. The second plug 17 is not drawn toward the partition wall 37 and pressed thereon until
the contact second plug 17 is engaged with the first plug 1 is closed and the contact and the
engagement therebetween is tightened by means of the locking lever 160. The recess-An
15 engagement element 176 in the form of a recess allows the engagement of engages with an
actuating projection element 178 (Fig. 4) in the form of a projection formed on the locking lever
160 for drawingelamping the two first and second plugs 1, 17 against the partition wall 37-(see
Fig. 4). With regard to its operating principle, the engagement element 176 is configured as a
reduced rack, which cooperates with the actuating element 178 configured as part of a gear-
20 wheel.

To prevent the second plug 17 from falling out of the partition wall 37 when undergoing
mechanically stressed-mechanical stress during fitting, a locking device 102 is further provided,
which operates by blocking inward deflection of the catch arm 152 in the locked state so that the

second plug 17 can no longer fall out of the opening 39. In the illustrated embodiment, the resilient catch arm 152 is formed integrally on the plastic second plug housing 25 of the second plug17.

As will be illustrated shown in Fig. 5, the locking device 102 comprises a catch lug 110, which, in both the locked and the unlocked state, latches in a corresponding catch opening 124, and 126 so that the locking device 102 is captively secured in both positions. The locking device 102 is movable between the locked position and the unlocked position in the a direction of arrow 150 (Fig. 3), i.e., which is in the direction in which the two first and second plugs 1₁ and 17 are plugged together. This is advantageous, in particular, because the locking device 102 can therefore be accessed particularly easily from the an exterior of the second plug housing 25 and can easily be locked and also released again unlocked by a user. Two elongated cut outs 154 also allow flexible movability of the catch lug 110. An actuating projection 156 simplifies operation of the locking device 102 by a user. The faces Faces 158 (see Fig. 5) have the function of blocking are configured to block the catch hooks lugs 131 in the locked state.

15 ———A drip proof cap 26 covers the second plug 17 and thus protects itthe second plug 17 from the penetration of drips.

The first plug 1 is shown here in Fig. 3 with the locking lever 160 pivoted upwards. The securing device 170, which is displaceably mounted on the housing 2, is located, in the illustrated view, in a position in which latching with the catch lug 172 is permitted during subsequent pivoting of the locking lever 160. Once the locking lever 160 has pivoted about the an indicated axis of rotation 180, the securing device 170 can be pushed in the a direction of arrow 182 so that the catch lug 172 engages with the a projection 184 on the locking lever 160 and holds itthe locking lever 160 securely in itsthe locked position. An actuating projection 186 simplifies the

displacement of the securing device 170. To ensure secure guidance, the securing device 170 is also displaceably held in corresponding grooves 190 on the first plug housing 2. Finally, a securing tab 188 is formed on the securing device 170 to prevent displacement of the securing device 170 in the a direction of arrow 182 until it is pressed against the first plug housing 2 by 5 the folded down locking lever 160 and allows the securing tab 188 to be displaceable into the groove 190.

Fig. 4 shows the first embodiment of the first plug 1 in an exploded view.—Referring to Fig. 4, the first and second pin recesses 5, 6 are configured to be complementary to one another in certain regions so that the first pin recess 5 can be inserted into the second pin recess 6 in the a 10 direction of the arrow 8 in certain regions. In the plugged together state, the first and second pin recesses 5, 6 can be introduced into the interior of the first plug housing 2 in the a direction of the arrow 9. A catch device 192 ensures that they the first and second recesses 5, 6 are held securely in the first plug housing 2. In accordance with the invention, the first plug housing 2 comprises substantially circular bearing recesses 168 through which the bearing projections 164 dip and are 15 received to allow rotatability about the axis of rotation 180 which is indicated in a broken line.

According to the invention, an O-ring the sealing member 162 is pushed over the respective bearing projections 164 as a sealing device as shown in Fig. 4. This O-ring sealing member 162 prevents the penetration of moisture through the bearing opening 168 into the interior of the first plug housing 2. The first plug housing 2 is sealed from the partition wall 37 20 in the fitted state via the seal 28. This seal 28 can either be sprayed on or be produced as a prefabricated part made, for example, of silicone rubber, and fitted on the first plug housing 2. The locking lever 160 has a substantially U-shaped configuration with two legs, on which the bearing projections 164 are formed, and a base which engages with the securing device 170. The

fact that the locking lever 160 partially surrounds the housing 2 allows an arrangement which is as compact as possible to be produced.

A partportion of a gear-wheel which engages with the corresponding engagement elements 176 on the second plug housing 25 is constructed on the bearing projection 164 as the 5 respective actuating element 178 shown in Fig. 4. Advantageously, the actuating element 178 is configured as a portion of to have at least one tooth with an involute gear teeth and the tooth face 194, which has to withstand The actuating element 178 withstands all the force in the finally fitted state; and is formed on the solid material of the bearing projection 164 to allow better absorption of force and long-term stability.

10 The second plug 17 of the plug connector according to invention, according to the first embodiment, is shown in a partially exploded view As shown in Fig. 5. — The the second plug 17 has athe second plug housing 25, athe drip proof cap 26, and athe locking device 102.

———The drip proof cap 26 can be slid onto the second plug housing 25 in the a direction of the arrow 29. An outer periphery 30 of the second plug housing 25 engages with an encompassing 15 rim 31 of the drip proof cap 26.

———Once fitted, the drip proof cap is secured on the plug housing 25 by a catch 196.

———Referring to Fig. 5, the locking device 102 comprises an actuating projection 156 which simplifies operation of the locking device by the user. In the locked state, the faces 158 have the function of blocking the catch hooks 131.

20 ——Fig. 6 finally shows the second plug 17 again in the position held in the partition wall 37 in readiness a state ready for plugging.

Operation of the first embodiment of the plug connection 100 of the associated method of fitting, shown in Figs. 1 to 6, will be described hereinafter.

The first plug 1 is initially pre-fitted. Referring to Fig. 4, the first pin recess 5 is introduced into the second pin recess 6 in certain portions in the direction of the arrow 8. In this state, the first and second pin recesses 6, 5 are inserted into the interior of the first plug housing 2 in the direction of the arrow 9. A bush (not shown here) can then be pushed over the connecting piece 7 in certain regions. In addition, pins are fitted in the first and second pin recesses 5, 6 and a supply cable (not shown) is laid through the interior of the bush (not shown) into the interior of the first plug housing 2, and strands Conductors of the connecting supply cable (not shown) are connected to the corresponding pins, in order to fit the first plug 1.

The second plug 17 is fitted independently of this the first plug 1. In particular, the drip proof cap 26 is pushed onto the second plug housing 25 in the direction of the arrow 29 as shown in Fig. 5. Pins are also inserted into the second plug 17 and one or more supply lines are laid therein.

A connection can now be produced through the opening 39 in the partition wall 37 using the plug connection 100 according to the invention. The connection is an electrical connection in this embodiment.

Referring to Figs. 5 and 6, the second plug 17 is guided through the opening 39 in the partition wall 37 in the direction of the arrow 38. Guidance continues until the catch projections lugs 131 are secured on the partition wall 37. The locking device 102 is subsequently introduced into the second plug housing 25 in the direction of the arrow 103 and pushed down until it latches in the catch opening 124 and is thus secured against bending inwards by the faces 158 of the catch arm 152, so the second plug 17 is now secured captively in the partition wall 37.

The second plug 17 is now secured in its position relative to the position wall 37. In car production, this can be a pre-fitted state.

The first and second plugs 1, 17 can now be plugged together. Starting from the position of the first and second plugs 1, 17 shown in Fig. 3, the first plug 1 is guided onto the second plug 17 in the direction of the arrow 150 and plugged together with the second plug 17.

—A force is then applied to the actuating face 11 of the locking lever 116_160 so that the locking lever 116_160 is pivoted about the axis of rotation 180 and the force exerted is converted into a clamping movement by means of the gear wheel/rack arrangement actuating element 178, (Fig. 4) and the engagement element 176. Tension is thus built up until the actuating element 178 reaches its end position in the engagement element 176. The catch hook 172 also engages with the catch opening 174 (Fig. 2). In the next step, the securing device 170 is displaced in the direction of the arrow 182 (see Fig. 3), so that the catch hook 172 is secured on the projection 184 and the clamping device locking lever 160 is held against unintentional movement from the end position now adopted. Owing to the mechanical stress, the seal 28 is pressed against the partition wall 37 so that, together with the seal sealing member 162 of the locking lever 160, the first plug 1 is reliably protected from penetrating moisture in this position.

15 A second advantageous embodiment of the plug connection 100 according to the invention will now be described with reference to Figs. 7 to 16.

Referring to Fig. 7, the first plug 1 according to a-the second embodiment comprises a sliding device 704, instead of the clamping device configured as a-the locking lever 160, for clamping the two-first and second plugs 1, 17 together. The sliding device 704 is accommodated 20 displaceably in the first plug housing 2 in the direction of the arrow 10. The sliding device 704 comprises an actuating surface 11, to which a displacement force can be applied for displacing the sliding device 704.

The sliding device 704 comprises side elements 12, 13. As shown in Fig. 7, respective upper guide rails 14 and lower guide rails 15 are provided in the side elements 12, 13. The upper and lower guide rails 14, 15 are formed, for example, as guide recesses in this embodiment of the invention.

5 In Fig. 7, moreover, a proposed direction for plugging together the first plug 2 and the second plug 17 is indicated by ~~an~~-arrow 16. The direction of the arrow 10, in which the sliding device 704 can be displaced in the first plug housing 2, extends substantially transversely to the direction of the arrow 16 for plugging together the first plug 1 and the second plug 17. The upper and lower guide rails 14, 15 have step-down portions 18, 19 which extend in a direction
10 substantially transverse to the plugging-together direction shown by the direction of the arrow 16 and substantially transverse to the sliding direction shown by the direction of the arrow 10. The upper and lower guide rails 14, 15 also comprise end portions 20, 21 which extend parallel to the sliding direction shown by the direction of the arrow 10.

Referring to Fig. 8, the upper and lower guide rails 14, 15 cooperate with associated pin-like projections 33, 34 on the second plug 17 for clamping the ~~two~~first and second plugs 1, 17 together and against the partition wall 37.

——In accordance with the invention and in correspondence with the pin-like projections 33, 34, openings 72, 73, are provided in the first plug housing 2 through which the pin-like projections 33, 34 dip so as to cooperate with the sliding device 704, as shown in Fig. 7. The
20 openings 72, 73 are provided with peripheral sealing members 163 in order to seal this connection region and prevent the penetration of moisture into the interior of the first plug 1.

A peripheral seal 28 is also attached to the first plug housing 2. In the illustrated embodiment of the present invention shown in Fig. 7, the seal 28 is sprayed onto the first plug

housing 2. The seal 28 is therefore secured captively on the first plug housing 2, and the connection between the seal 28 and the first plug housing 2 is invariably tight. However, the seal 28 can also be a separate part-member from the first plug housing 2.

———The foregoing similarly applies to the sealing members 163, which are also sprayed on
5 the first plug housing in the illustrated embodiment.

In Fig. 8, the second plug 17 according to the second embodiment is shown in a partially exploded view. The elements of the second plug 17 which correspond to those in the first embodiment will not be mentioned again separately hereinafter.

In accordance with the invention, the second plug 17 in the second embodiment
10 comprises As shown in Fig. 8, the pin-like projections 33, 34 which are constructed integrally on the second plug housing 25. The pin-like projections 33, 34 are configured in such a way that they can the pin-like projections 33, 34 engage with the upper and lower guide rails 14, 15 of the sliding device 704 of the first plug 1 and thus represent an engagement means-member for the sliding device 704, which acts as a-the clamping device.

15 ——Sealing projections 198, which can are configured to form a tight joint with the sealing members 163, are also formed on the second plug housing 25 to seal assist in sealing the openings 72, 73 by means of the seals 163.

A resilient spring catch arm 152 with a holding device catch lug 131 in the form of a projection has the function of fastening the second plug 17 in the opening 39 in the partition wall
20 37, as will become apparent with reference to Fig. 10. A locking device 102 allows blocking of this resilient-blocks the spring catch arm 152 in order to lock the second plug 17 in the partition wall 37 by preventing inward bending of the spring catch arm 152 in the locked state.

———As will become more apparent from Figs. 15 and 16, the locking device 102 according to this the second embodiment has bearing projections 206, which are held in corresponding bearing recesses 208 (Fig. 8) on the second plug housing 25. The locking device 102 can therefore be moved about an axis of rotation 202 between a locked position and an unlocked position. In the unlocked position, the locking device 102 is secured in the a catch recess 210 and, in the locked position, in the a catch recess 212.

Fig. 9 is a perspective view of the first plug 1 in readiness-a state ready for plugging.

———Fig. 10 shows the second plug 17 in readiness-a state ready for plugging, with the locking device 102 being located in the locked position so that the second plug 17 is held securely in the partition wall 37. In this position, the an edge 204 of the locking device 102 also makes contact with the second plug housing 25 so that the a pin trough 128 (Fig. 16) in the second plug housing 25 is vacated and the two-first and second plugs 1, 17 can therefore be plugged together.

Fig. 11 shows a perspective, partially sectional view of the plug connection 100 according to the second embodiment of the invention, according to the second embodiment, in the finally fitted, plugged together state. According to the invention, the sealing devices seals 28, and the sealing members 163 ensure that the internal electrical connections are completely sealed against the penetration of moisture. The two when the first and second plugs 1, and 17 are firmly clamped with the partition wall 37.

The fitting of the second plug 17 in the partition wall 37 according to the second embodiment will be described in greater detail hereinafter with reference to Figs. 12 and 13. In contrast to the previous embodiment, a seal 27 similar to the seal 28 is provided on the second plug 17 for providing a seal from the partition wall 37. It is however clear to a person

will be appreciated by one skilled in the art, however, that the side of the partition wall 37 on which athe seal 27 is provided is immaterial to the principles according to the invention.

The locking device 102 is in the unlocked position, as shown in the partially open view in Fig. 12. For fitting, the second plug 17 is inserted obliquely into the opening 39 in the partition wall 37, the a proposed free distance 134 ensuring that the necessary tilting about the angle ex-a is possible.

After insertion, the second plug 17 is pivoted about the a lower edge in the a direction of arrow 112 so that the projection catch lug 131 also holds the second plug 17 in the partition wall 37. The locking device 102 can now be tilted in the a direction of arrow 113, so that, on the one hand, inward pressing of the catch hook-lug 131 is prevented and, on the other hand, the projections 214, 216, which are shown more clearly in Figs. 15 and 16, cooperate with the partition wall 37 so as to hold the second plug 17 in the opening 39 in the partition wall 37.

In the illustrated embodiment, the second plug 17 is also still displaceable by the distance 137-134 transversely to the plugging-together direction in the pre-fitted position shown in Fig. 13. In the position of the locking device 102 shown in Fig. 13, the pin trough 128 is vacated so plugging together can now take place.

The fitting step shown in Fig. 12- is shown again in a perspective view in Fig. 14. It is apparent that the locking device 102, which is latched in the unlocked position in this drawingFig. 12, blocks the pin trough 128 with its edge 204. This ensures that the second plug 17 and the first plug 1 can only be plugged together in the completely locked state. Fitting errors can thus be detected promptly and eliminated.

Figs. 15 and 16 show two detailed views of the second plug 17, illustrating the mode of operation of the locking device 102 more clearly. Fig. 15 shows the unlocked state, in which the

locking device 102 is latched in the catch recess 210 in such a way that the pin trough 128 for plugging the two first and second plugs 1, 17 together is blocked. As will become apparent from comparison with Fig. 8, the locking device 102 is held in the bearing recesses 208 by means of the bearing projections 206 in such a way that it is pivotal in the direction of the arrow 113. In 5 the locked position shown in Fig. 16, on the one hand, the movement of the catch hook-lug 131 is blocked and, in addition, the projections 214, 216 dipping through the second plug housing 25 secure the second plug 17 directly in the partition wall 37. The second plug 17 is held in the partition wall 37 on the opposite face of the second plug housing 25 by the a fixed holding projection-structure 132 (Fig. 14).

10 Figs. 17 to 26 show is a perspective view of a further advantageous third embodiment of the plug connection 100 according to the invention. As in the second embodiment, a sliding device 704 for clamping the two first and second plugs 1, 2-17 together is also provided here. In order to be able to release the sliding device 704 again without difficulty, if necessary, a recess 218 that allows a user to grasp the sliding device 704 securely is provided on either side of the 15 first plug housing 2. Catch recesses 220, and 224 with associated catch hooks 226 (see also Fig. 20) secure the sliding device 704 on the first plug housing 2. In particular, the catch hook 226 engages in the catch recess 220 in the finally fitted state and is secured by the catch recess 224 in the pre-fitted state.

In addition to the a peripheral catch projection 228 shown in conjunction with the second 20 embodiment, the connecting piece 7 has a resilient catch arm 230 in the embodiment shown here. Both the peripheral catch projection 228 and the catch arm 230 allow the mechanical fixing of a bush, (not shown) in detail here.

As shown in Fig. 18, is a perspective view of the second plug 17 in Fig. 17. The the second plug 17 is positioned in the partition wall 37-, but is not yet finally fixed. The A locking device 102 is still in the a pre-catching position. According to the present embodiment, locking in the partition wall 37 is achieved here solely via the a resilient spring catch arm 152 and the a holding structure catch lug 131 formed thereon and via the an opposing holding structure 132. As will become apparent shown in the following Fig. 19, the locking device 102 holds the spring catch arm 152 in the locked position in the finally latched state.

Fig. 19 shows the plug connection 100 from Fig. 17 before the first and second plugs 1, 17 are plugged fitted together. The second plug 17 is held firmly in the partition wall 37 in this phase, and the locking device 102 holds the spring catch arm 152 in the position shown. The first plug 1 is located in a position in readiness state ready for plugging, in which the sliding device 704 is latched by means of the catch openings recesses 224 in a pre-fitted state.

Fig. 20 shows the first plug 1 in the embodiment shown in Fig. 17 in a view similar to Fig. 7. The explanations given with respect to the second embodiment basically also apply accordingly to the embodiment shown in Fig. 20. In particular, the functionality of openings 72_a and 73 provided with peripheral sealing members 163 and the functionality of the sliding device 704 correspond to those of the second embodiment. As already mentioned, in the present embodiment, the sliding device 704 has the catch hooks 226 so that it can be held securely in the first plug housing 2 in both a pre-catch position and the finally fitted position. The first pin recesses recesses 5 and the second pin recesses recesses 6 have a are somewhat modified, form. However, however, this configuration should be taken only as an example, as the principles according to the invention can advantageously be employed with any plug shapes. Owing to the

recesses 218, the an actuating face 11 of the sliding device 704 can extend rectilinearly in the third embodiment, and this reduces the space required.

Fig. 21 is a perspective view of the first plug 1 according to the embodiment shown in Fig. 20, in readiness for plugging.

Fig. 22 shows the a peripheral seal 28 for sealing the second plug 17 from the partition wall 37 and the sealing devices members 163 released from the plug connection 100. According to the present advantageous embodiment, the four sealing devices members 163 are produced integrally with the seal 28 in that they are connected to the seal 28 via webs 199. This configuration has the advantage of simplified production in one operation both as a separately laid in sealing arrangement and as a seal which is sprayed onto the plug 1. In the latter case, it is not necessary to provide undesirable injection points on the fine structures of the sealing devices members 163. In addition, this embodiment allows a reliable seal in the region of the projections 33, 34.

Fig. 23 shows the second plug 17 according to the embodiment from Fig. 19 in readiness a state ready for plugging, with the second plug 17 being fitted in the partition wall 37 and the seals 28, and the sealing members 163 from Fig. 21 also being shown to illustrate the position thereof. In this embodiment, the seal 28 and the sealing devices members 163 are in turn constructed in one piece in that the webs 199 produce a joint.

Figs. 24 and 25 show the configuration of the locking device 102 in the embodiment shown in Fig. 18 and in the unlocked position in detail. The functionality of the locking device 102 basically corresponds to the principles described with reference to Figs. 15 and 16.

Fig. 26 shows the second plug 17 from Fig. 19 in a partially exploded view. In comparison with the similar embodiment shown in Fig. 8, the simplified configuration of the

pivotal locking device 102 is of particular importance in this embodiment. The locking device 102 is configured without the projections 214, 216 dipping through the second plug housing 25. Regardless of this, however, any functional mechanisms described with respect to the foregoing configurations can also be transferred to the present embodiment.

5 With the aid of the plug connection 100 according to the invention, on the one hand, the tightness cannot be influenced by the pull of the cable and, on the other hand, an optimum sealing function relative to ~~a-the~~ partition wall 37, for example a vehicle body panel, is ensured owing to the axial seal 28 at the ~~socket~~ first plug 1. The pin trough 128 is protected from dripping water, and fitting as well as removal are simple and clear. Closure of the coupling 10 produces a defined sealing fit between the second plug 17 and partition wall 37 in addition to the electrical contact. Finally, the Kojiri security ~~Additionally, a seal~~ can be ensured by ~~a-the~~ deep trough and ~~a-the~~ high protective web 199.

CLAIMSWHAT IS CLAIMED IS:

ABSTRACT

A plug connection comprises a first plug having a seal and a second plug configured for fitting in an opening in a partition wall. The second plug is mateable with the first plug such that the seal substantially surrounds the opening in the partition wall. A clamping device is provided 5 on the first plug and is configured for drawing the first plug into engagement with the second plug. The clamping device engages with the second plug at a connection region. The connection region is provided with a sealing member configured to seal the connection region between the clamping device and the second plug. The present invention relates to a plug connection for producing at least one electrical connection through an opening (39) in a partition wall (37). The 10 plug connection comprises a first and a second plug (1, 17), which can be plugged together, and at least one of the plugs can be sealed from the partition wall by means of a seal (28) that surrounds the opening. The invention relates, in particular, to a plug connection, at least one of the plugs of said connection comprising a clamping device which can be engaged with the other plug and enables the two plugs to be clamped permanently in their plugging together direction 15 with interposition of the partition wall. The invention also relates to a method of fitting for producing an electrical plug connection of this type. To increase the seal against the environment and the reliability of the connection, the clamping device comprises at least one sealing device (162) for sealing a connection region between the clamping device and the at least one plug (1, 17).

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Fig. 1